Applicants have discovered that when the ceramic substrate satisfies the above-recited "pore" limitation, it is possible to successfully address various problems in prior art ceramic substrates, such as temperature rising/dropping characteristics which are insufficient, breakdown voltage dropping at high temperature, and warp caused by Young's modulus dropping.

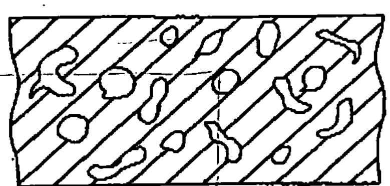
The ceramic heater of the present invention is superior in breakdown voltage at temperatures of 25°C or higher. Note that with the presently-recited pore limitation, the drop in breakdown voltage is suppressed even in the high temperature range of 200°C or higher. For example, as shown in Table 1 at page 34 of the specification, the breakdown voltage at a temperature of 200°C is 4kV/mm when the number/m^2 of pores is 10×10^{11} (Example 7) whereas the breakdown voltage at 200°C is 0.8kV/mm when the number/m^2 of pores is 18×10^{11} (Comparative Example 1). These examples demonstrate that the value of the breakdown voltage dramatically drops between these number/m^2 values. Thus, when the number/m^2 of pores is 15×10^{11} or less, it is possible to secure sufficient breakdown voltage at 200°C or more. The **attached** graph dramatically demonstrates the data, wherein the logarithm of the number of pores is the abscissa (wherein log(0) is taken as 0, rather than -∞ for convenience), and breakdown voltage is the ordinate.

The rejection of Claims 1-2 and 4-6 under 35 U.S.C. §102(b) as anticipated by U.S. Patent No. 5,279,866 (Kawai et al) is respectfully traversed.

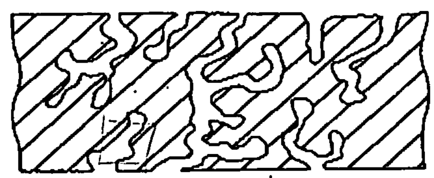
Kawai et al disclose an alumina sintered body on which a heater electrode is printed and which is sintered simultaneously with the heater electrode at temperatures lower than the optimum value 1,520°C, thus forming a ceramic heater. Kawai et al disclose that the minimum sintering temperature, or the temperature at which no open pores are observed, was determined for each heater.

In reply, that the ceramic substrate of Kawai et al may not contain open pores does not mean that the substrate is non-porous. In Kawai et al, open pores are synonymous with continuous pores, each of which pores is mutually connected, from the surface to the inside, or even to the other side, and gas and liquid can be transferred through them. Closed, or independent, pores, on the other hand, are pores, each of which is independent from each other and gas or liquid cannot be transferred through them. A pictorial representation of closed pores and open pores is shown below: (1)

The closed pores



The open pores



Kawai et al disclose nothing with regard to closed pores. Indeed, that Kawai et al is only concerned with open pores is the disclosure beginning at column 6, line 5 regarding dipping each sintered heater in a red check solution and washing with water, and then determining the sintering temperature at which the red check solution was swept away. If open pores were formed, the internal red check liquid could not easily be washed off because the liquid would penetrate inside the pores. For closed pores, on the other hand, the red check liquid would enter only pores at a surface layer, which thus makes it possible to easily wash off. In the present invention, even if open pores do not exist, as long as closed pores exist, at an amount greater than the maximum recited in the claims, the object of the present invention cannot be achieved. The present invention concerns the number of existing pores regardless of whether these are open or closed pores. (2) (3)

The newly-submitted Osaki Declaration confirms the presence of closed pores in Kawai et al, and in a concentration greater than the presently-recited maximum. Indeed, the Osaki Declaration shows a value of at least 19.0×10^{11} pores per m^2.

In addition, regarding the durability test disclosed at column 6, lines 26-27 of Kawai et al, only 13 V of voltage at 1,000°C was supplied. Considering the fact that the thickness of the green sheet is 0.27 mm which is described at column 3, line 54 of Kawai et al, the breakdown voltage is only 48 V/mm. This is considerably lower than 400 V/mm, the value of the breakdown voltage of the ceramic heater of the comparative example described herein. It is thus clear that the breakdown voltage of Kawai et al's ceramic heater is far inferior to that of the present invention. Nor would one skilled in the art be able to derive any relationship between number of pores and breakdown voltage from Kawai et al. In addition, the ceramic heater of the present invention does not even have closed pores, and thus, in this respect also, it is different from the ceramic heater of Kawai et al.

For all of the above reasons, it is respectfully requested that the rejection over Kawai et al be withdrawn.

The rejection of Claims 1-10 and 12 under 35 U.S.C. §103(a) as unpatentable over Kawai et al in view of U.S. Patent No. 5,338,598 (Ketcham), is respectfully traversed. The disclosure and deficiencies of Kawai et al have been described above. Ketcham does not remedy these deficiencies. Ketcham is directed to a sintered body for use as, for example, composite armor, cutting tools, high temperature structural materials and/or wear parts for air-frames or heat engines, electrically-insulating substrates for integrated circuits, and precision parts such as magnetic head sliders (paragraph bridging columns 11 and 12). The Examiner particularly relies on Ketcham's disclosure of "essentially zero open porosity" (column 3, line 43), as meeting the presently-recited "pore" limitation, which does not

exclude a non-porous condition. However, Ketcham neither discloses nor suggests a ceramic heater, let alone one comprising the presently-recited ceramic substrate and temperature control means, which requires an insulation property at high temperature. Nor could one skilled in the art have predicted the above-discussed comparative data from the disclosure of Ketcham. Finally, even if Kawai et al and Ketcham were combined, the result would still not be the presently-claimed invention.

For all of the above reasons, it is respectfully requested that the rejection over Kawai et al in view of Ketcham be withdrawn.

The rejection of Claim 3 under 35 U.S.C. §112, second paragraph, is respectfully traversed. The Examiner has required Applicants to submit documents or articles explaining the meaning of a "Peltier device." In reply, **submitted herewith** is a copy of a definition from the introductory part of chapter 1 of General Information on Peltier Devices in Peltier Device Information Directory by Steve J. Noll (http://www.peltier-info-com/info.html). Accordingly, it is respectfully requested that this rejection be withdrawn.

Applicants gratefully acknowledge the Examiner's indication of allowability of the subject matter of Claim 11. Nevertheless, Applicants respectfully submit that all of the

presently-pending claims in this application are in condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

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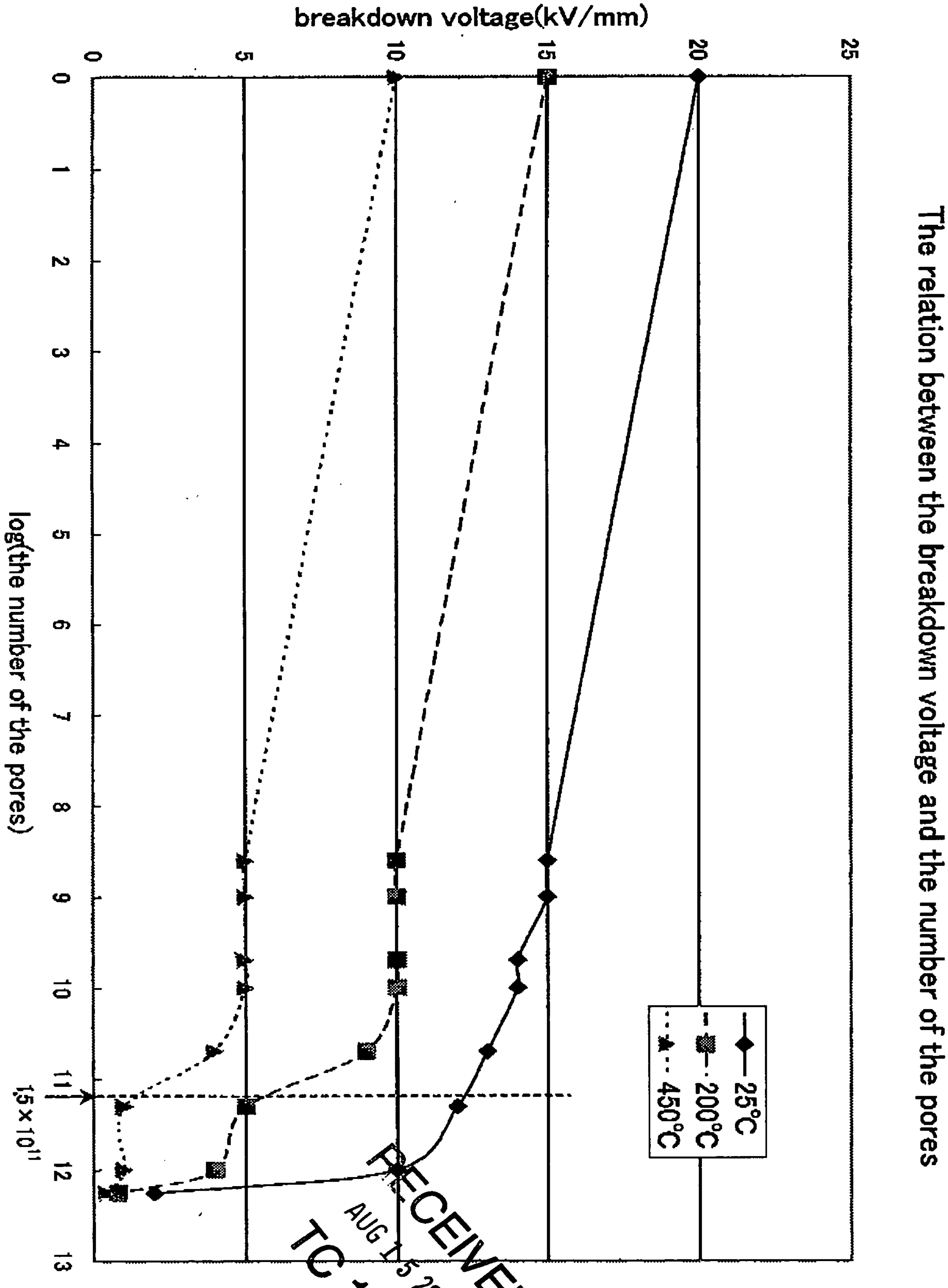

The article on the next page is submitted to the examiner in response to the claim rejection under 35 U.S.C 112, second paragraph. The article relates to peltier device, cited from the introduction part of chapter1: General Information on Peltier Devices in Peltier Device Information Directory by Steve J. Noll. (http://www.peltier-info.com/info.html)

Peltier devices, also known as thermoelectric (TE) modules, are small solid-state devices that function as heat pumps. A "typical" unit is a few millimeters thick by a few millimeters to a few centimeters square. It is a sandwich formed by two ceramic plates with an array of small Bismuth Telluride cubes ("couples") in between. When a DC current is applied heat is moved from one side of the device to the other - where it must be removed with a heatsink. The "cold" side is commonly used to cool an electronic device such as a microprocessor or a photodetector. If the current is reversed the device makes an excellent heater.

As with any device, TE modules work best when applied properly. They are not meant to serve as room air conditioners. They are best suited to smaller cooling applications, although they are used in applications as large as portable picnic-type coolers. They can be stacked to achieve lower temperatures, although reaching cryogenic temperatures would require great care. They are not very "efficient" and can draw amps of power. This disadvantage is more than offset by the advantages of no moving parts, no Freon refrigerant, no noise, no vibration, very small size, long life, capability of precision temperature control, etc.